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ABSTRACT

This document contains an introduction to the Ohio Integrated Technical and Academic Competency (ITAC) and Specialization ITAC; an overview of the drafting industry; a list acknowledging professionals who helped develop the competency list; and the comprehensive list of the professional or occupational competencies deemed essential for graduates to be able to perform proficiently when they graduate from an Ohio specialization workforce development program on drafting. The introduction explains the following: (1) critical academic, employability, and information technology skills have been integrated throughout the list to support the technical skills; (2) the competency profile can be used as the basis for curriculum development in Ohio's secondary, adult, and postsecondary programs; and (3) the specialization competency profile is organized so that it can be clustered or grouped in a modular approach. The overview of the drafting industry describes general duties, some specific tasks, employment opportunities, length of program, type of program (classroom instruction and/or work experience), and types of certificates and/or degrees. The competencies are grouped under broader skills that are, in turn, categorized under these 11 major topics: orientation to the drafting industry; safety in the drafting industry; basic drafting lab skills; geometric constructions; orthographic projections; pictorials; development drawings; dimensioning techniques; machine drawings; residential architecture; and electrical and electronic drawings. (YLB)

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Specialization Integrated Technical and Academic Competency (ITAC)

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Acknowledgements

Overview

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26.09.00.0	Machine Drawings
26.10.00.0	Residential Architecture
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Bob Taft, Governor | Susan Tave Zelman, Superintendent of Public Instruction
Contact ODE | Web site notes | Contact Web Manager | ODE home | Ohio home
Ohio Department of Education, 25 South Front Street, 6th Floor, Columbus, Ohio 43215-4183
1-877-644-6338
Career-Technical and Adult Education 614-466-3430

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Introduction to the Specialization ITAC

Revised 2001

The Ohio Integrated Technical and Academic Competency (ITAC) profiles are developed under the auspices of the Ohio Department of Education and the Ohio State Board of Education. They provide a broad-based educational response to Ohio's need for a skilled workforce. Each Specialization ITAC represents a profile of the professional or occupational competencies deemed essential for a graduate to perform proficiently when he or she graduates from the specialization workforce development programs in Business and Marketing, Industrial and Engineering Systems, Health Occupations, or Family and Consumer Sciences. The Specialization ITAC profile, in conjunction with the competencies identified in the Foundation and Clusters ITACs, provide a career pathway that can lead to employment or further education.

Process and Intent

The integrated competency lists are the result of all encompassing research and review of existing competency profile lists and includes input from industry, labor, professional organizations, professional and industrial representation, and national standards for a specific industry/profession. Representatives from a broad cross-section of Ohio professional organizations, businesses/professions, industry, and labor played a critical role in identifying current and future knowledge and skills for the industry, and defining the vision and scope of the profession/industry. The instructional methods and teaching strategies are the responsibility of the local school system and/or instructor.

Curriculum Applications Using the ITAC Competency Profiles

Each profile includes a comprehensive listing of occupational skill competencies that reflect the job opportunities and skills that are required to work in a specific profession/career pathway. Critical academic, employability and information technology skills have been integrated throughout the list to support the technical skills. These competency profiles will be used as the basis for curriculum development in Ohio's secondary, adult, and post-secondary programs. The specialization competency profiles are organized so that they can be clustered or grouped in a modular approach. Individual curriculum specialists can use the competencies profiles to develop instructional programs based on local needs as determined in conjunction with their local advisory committees. i.e., the specialization cluster academy approach. Final assessments will be designed to accompany each profile list and to accommodate student evaluation by modules.

Career Pathways | FasTrak ITACs

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Drafting

Vicki Melvin, Interim Director

Industrial and Engineering Systems and Health Careers

Robert Bowermeister, Assistant Director
Joyce R. Boudreau, Consultant
Michael Cowles, Consultant
Gayle Parlin, Consultant
Richard Wancho, Consultant

Curriculum Consultants

Dee Allenspach
Joyce Leimbach

Professional Panel

Jay Bond, Jr., Superior Machine Systems, Fairfield
Robert Policy, Micro-Matic Tool, Inc., Youngstown
Robert E. Platt, Micro-Matic Tool, Inc., Youngstown
Clark J. Fillinger, Retail Design Group, Inc., Columbus
Robert Heeg, Image Technology, Inc., Cleveland
John Mand, Nifco LLC, Groveport
Robert E. Ferrell, Jr., The Ntl. Bd of Boilers and Pressure Vessel Inspectors, Columbus
Ted Hager, M-Engineering Corporation, Westerville
Kevin Robinson, The CAD Zone, Cincinnati
Tony Medzi, Goodrich Corp., Uniontown
Benjamin Pack, Inner Circle Logistics, Columbus

Educational Review Panel

Wayne Stiffler, Gordon James Career Center, Lordstown
Kelly Harrison, Delaware County Joint Vocational School, Delaware
Lisa Poff, Delaware County Joint Vocational School, Delaware
Charlie Hancock, Licking County Joint Vocational School, Newark
William Poe, Greene County Joint Vocational School, Xenia
Jerry Spencer, Technology Center, Tiffin
Dennis O'Brian, Medina County Career Center, Medina
Michael Haydn, Polaris Career Center, Middleburg Heights
Kenneth C. Porter, Ashtabula County Joint Vocational School, Jefferson
Philip Spicer, Vanguard-Sentinel Technology Center, Freemont

Overview

Drafting

Drafters translate the ideas and rough sketches of engineers, architects, and scientists into detailed drawings, which enable other workers to manufacture the product or construct the project. Their technical drawings and plans are used by production and construction workers to build everything from manufactured products such as spacecraft or industrial machinery to structures such as office buildings or oil and gas pipelines. Their drawings provide visual guidelines, showing the technical details of the products and structures, specifying dimensions, materials to be used, and procedures and processes to be followed. Drafters fill in technical details, using drawings, rough sketches, specifications, codes, and calculations previously made by engineers, surveyors, architects, or scientists. Their duties may include interpreting directions given to them, making sketches, preparing drawings to scale, and specifying details. They use various drafting tools, engineering practices, and mathematic skills to complete drawings.

Drafters commonly use computer-aided design (CAD) systems. These systems make it easy to prepare many variations of a design and allow it to be viewed from angles not usually available with traditional drafting methods. The computer-aided drafting (CAD) systems employ computer workstations, which create a drawing on a video screen. The drawings are stored electronically so that revisions or duplications can be made easily. These systems also permit drafters to easily and quickly prepare variations of a design. Although this equipment has become easier to operate, CAD is only a tool. Persons who produce technical drawings using CAD still function as a drafter, and need most of the basic knowledge of traditional drafters-relating to drafting skills and standards-as well as CAD skills.

Employers include engineering and architectural firms, construction companies, and government agencies. Drafters may advance to positions requiring more skill and experience such as technical assistant, illustrator, senior drafter, designer, or supervisor. Over 35 percent of all drafters work in engineering and architectural service firms that design construction projects or do other engineering work on a contract basis for organizations in other industries. Another 29 percent work in durable goods manufacturing industries, such as machinery, electrical equipment, and fabricated metals. The remainder are employed primarily in the construction; communications, utilities, and personnel supply service industries, or are self-employed.

Widespread use of computer-aided design techniques increases the demand for more highly skilled applicants. Opportunities will be best for those trained in the use of computer-aided drafting systems and electronic drafting equipment. Students should take courses in mathematics, science, computer technology, design, or computer graphics, and any high school drafting courses available. Mechanical and visual aptitude is also important. Drafters should be able to sketch three-dimensional objects, and do detailed work accurately and neatly. Artistic ability is helpful in some specialized fields, as is knowledge of manufacturing and construction methods. Drafters have the opportunity to see a project evolve from an idea to a completed product.

26.00.00.0 Drafting

26.01.00.0 Orientation to the Drafting Industry

26.01.01.0 Define the industry

26.01.01.01 Present an overview of the drafting profession
26.01.01.02 Identify the professional and/or trade associations related to the drafting profession
26.01.01.03 Identify American National Standards Institute, Inc. (ANSI), International Standards Organization (ISO) standards and terminology, American Design Drafting Association (ADDA), and other professional associations
26.01.01.04 Identify areas of specialization and related occupations within the drafting profession
26.01.01.05 Identify the employment opportunities in the drafting profession

26.01.02.0 Determine skills needed to work in the industry

26.01.02.01 Match drafting occupational job titles with qualifications and responsibilities
26.01.02.02 Identify education and training required to work in the various drafting careers
26.01.02.03 Describe the kinds of work techniques, processes and procedures a typical drafter might be called on to perform

26.02.00.0 Safety in the Drafting Industry

26.02.01.0 Practice Lab Safety

26.02.01.01 Name the agencies that provide safety regulations for the profession (i.e., OSHA, EPA)
26.02.01.02 Describe the safety procedures as outlined on MSDS
26.02.01.03 Identify consequences of disregarding safety rules
26.02.01.04 Identify location of classroom fire extinguishers and fire exits from the building
26.02.01.05 Demonstrate knowledge of appropriate actions to take in response to given emergencies
26.02.01.06 Lift/transport objects and materials in accordance with established safety practices

26.02.02.0 Protect workers from ergonomic injuries

26.02.02.01 Identify cause and effect of work practices to prevent ergonomics injuries
26.02.02.02 Maintain work practices to prevent eye damage
26.02.02.03 Maintain posture to prevent injuries

26.03.00.0 Basic Drafting Lab Skills

26.03.01.0 Follow drafting room procedures

26.03.01.01 Identify drafting terminology
26.03.01.02 Perform storage and retrieval (e.g., backup and archival methods)

26.03.02.0 Use Tools and Equipment

26.03.02.01 Select proper drawing methods, media, and equipment to complete a given project
26.03.02.02 Demonstrate proper use and care of drawing equipment
26.03.02.03 Produce copies
26.03.02.04 Use data translation techniques (e.g., Drawing Exchange Files [DXF])

26.03.03.0 Demonstrate basic drawing skills

26.03.03.01 Layout drawings
26.03.03.02 Construct borders and information blocks
26.03.03.03 Construct freehand sketches
26.03.03.04 Read and transfer measurements (i.e., English and metric)
26.03.03.05 Letter freehand (letters and numerals)
26.03.03.06 Add and edit text
26.03.03.07 Demonstrate line techniques (e.g., weights, types and uniformity)
26.03.03.08 Construct reproducible drawings
26.03.03.09 Perform basic geometric construction (e.g., line dividing, angles, tangents, polygons, arcs)
26.03.03.10 Identify and use various annotation methods per ANSI Standards (i.e., notes and dimensions)
26.03.03.11 Setup/plot drawings and details to proper scales

26.03.04.0 Apply mathematical skills

26.03.04.01 Apply basic mathematical principles (e.g., geometric, algebra, trigonometry)
26.03.04.02 Apply geometric formulas (e.g.. volume, area, and rate solutions)

26.03.05.0 Demonstrate CAD skills

26.03.05.01 Perform drawing setup to applicable standards (e.g., settings, layers, line types and widths)
26.03.05.02 Identify use, view, display commands (e.g., zoom, pan, viewpoints)
26.03.05.03 Create, edit and retrieve component/symbol libraries (e.g., groups, blocks, symbols, third-party libraries)
26.03.05.04 Use methods of sharing drawings (e.g., team projects, external references)
26.03.05.05 Describe multiple coordinate systems (e.g., absolute, relative, user coordinate system)
26.03.05.06 Develop 3-D dimensional models (e.g., wire frame and solid modeling)
26.03.05.07 Create orthographic views from 3-D models

26.04.00.0 Geometric Constructions

26.04.01.0 Apply basic measurement systems

26.04.01.01 Measure using fractions
26.04.01.02 Measure using decimals
26.04.01.03 Measure using metric units
26.04.01.04 Convert fractions, decimals, and metric measurements

26.04.02.0 Apply geometric construction techniques

26.04.02.01 Construct straight lines
26.04.02.02 Construct angles
26.04.02.03 Construct plane figures and shapes
26.04.02.04 Construct circles and arcs

26.05.00.0 Orthographic Projections

26.05.01.0 Determine the appropriate views of given objects (i.e., top, front, sides)

26.05.01.01 Determine proper orientation of object
26.05.01.02 Select proper view(s)

26.05.02.0 Construct, sketch and/or draw views of given objects showing visible and hidden features per ANSI Standards

26.05.02.01 Illustrate proper views including special views (i.e., section and auxiliary views)
26.05.02.02 Use ANSI Standards to evaluate appropriate placement of views

26.05.03.0 Draw auxiliary views

26.05.03.01 Construct primary/secondary auxiliary views (e.g., incline planes, curved surfaces, true length, true angles, true distance, true shape)
26.05.03.02 Determine auxiliary view placement

26.06.00.0 Pictorials

26.06.01.0 Sketch pictorial views

26.06.01.01 Sketch oblique view
26.06.01.02 Sketch perspective view
26.06.01.03 Sketch isometric view

26.06.02.0 Construct pictorial drawings

26.06.02.01 Construct oblique view
26.06.02.02 Construct perspective view
26.06.02.03 Construct isometric view

26.07.00.0 Development Drawings

26.07.01.0 Construct development drawings

26.07.01.01 Determine transition sizes and shapes
26.07.01.02 Construct drawings (e.g. transitions, cone, elbow, prism, cylinder)

26.07.02.0 Construct development models from development drawings

26.07.02.01 Layout models on media from drawings
26.07.02.02 Assemble models

26.08.00.0 Dimensioning Techniques

26.08.01.0 Demonstrate dimensioning techniques

26.08.01.01 Apply dimensioning rules per ANSI Standards
26.08.01.02 Determine/select appropriate dimensioning systems (e.g., fractional, decimal, metric)
26.08.01.03 Select/set/draw appropriate dimension features (i.e., arrowhead, text sizes, extension lines)
26.08.01.04 Draw/select appropriate dimensioning practices (e.g., conventional, tabular, datum, ordinate, aligned, rectangular coordinate, polar systems)
26.08.01.05 Apply geometric tolerances (e.g., true position, form, material conditions, datum points, reference
26.08.01.06 Identify/apply symbols for surface and texture control
26.08.01.07 Add notes to drawing (e.g., general, keynotes, revisions)

26.08.02.0 Apply tolerances

26.08.02.01 Interpret tolerance dimensions
26.08.02.02 Calculate tolerances
26.08.02.03 Dimension fit tolerances of mating parts (e.g., clearance, interference)
26.08.02.04 Assign tolerances to mating parts using standard fit tables

26.09.00.0 Machine Drawings

26.09.01.0 Identify shop processes

26.09.01.01 Identify machining operations
26.09.01.02 Identify manufacturing processes
26.09.01.03 Identify types of parts to be detailed (i.e., cast, machined, forged, sheet metal, welded, extruded, vacuum formed, stamped, molded)
26.09.01.04 Identify types of material
26.09.01.05 Identify welds and symbols

26.09.02.0 Identify fasteners and springs

26.09.02.01 Identify screw-threads
26.09.02.02 Identify common fasteners (i.e., pop rivet, solid rivet, nuts, bolts, screws, washers, retainers, pins, keys)K Identify springs

26.09.03.0 Draw details

26.09.03.01 Identify manufacturing possesses required
26.09.03.02 Identify materials
26.09.03.03 Detail parts including appropriate notes and dimensioning
26.09.03.04 Draw assemblies
26.09.03.05 Produce assembly drawings
26.09.03.06 Develop parts list/bill of materials
26.09.03.07 Identify details with parts list (e.g., apply callouts, label parts)
26.09.03.08 Draw/add fasteners
26.09.03.09 Draw exploded assemblies
26.09.03.10 Draw sectioned assemblies

26.09.04.0 Identify basic pneumatic/hydraulic drawings

26.09.04.01 Identify symbols for fittings in written descriptions
26.09.04.02 Identify symbols in single-line drawings
26.09.04.03 Identify pipe fittings in double-line drawings (i.e., welding, threaded)
26.09.04.04 Identify piping isometric drawings
26.09.04.05 Identify hydraulic/pneumatic systems

26.09.05.0 Identify cam and gear drawings

26.09.05.01 Identify different types of gears
26.09.05.02 Identify gear ratios and formulas
26.09.05.03 Determine gear rotation
26.09.05.04 Identify types of cam
26.09.05.05 Identify different types of power transmission (i.e., gears, belts, sprockets)

26.09.06.0 Create design

26.09.06.01 Identify design constraints
26.09.06.02 Draw a design layout
26.09.06.03 Determine materials
26.09.06.04 Determine ranges of motion of moving parts to ensure clearance
26.09.06.05 Apply reference information (i.e., bearings, gears, fittings, retainers, pulleys)
26.09.06.06 Determine tolerances, allowances and fits
26.09.06.07 Determine method of assembly (i.e., thread callout, fasteners)

26.10.00.0 Residential Architecture

26.10.01.0 Draw floor plan from preliminary sketch

26.10.01.01 Draw floor plan(s) to appropriate scale
26.10.01.02 Dimension plan with annotations
26.10.01.03 Prepare door, window schedules
26.10.01.04 Identify need for building codes and references

26.10.02.0 Draw foundation plan

26.10.02.01 Draw foundation plan(s) to appropriate scale
26.10.02.02 Dimension plans with appropriate annotation (i.e., footing size, floor framing)

26.10.03.0 Draw elevations

26.10.03.01 Draw exterior elevations (all sides)
26.10.03.02 Dimension elevation drawings
26.10.03.03 Note various materials by name

26.10.04.0 Draw sections and details

26.10.04.01 Determine drawing scale
26.10.04.02 Draw typical wall section
26.10.04.03 Draw longitudinal and/or cross section
26.10.04.04 Draw stairway section
26.10.04.05 Draw typical cabinet elevations

26.10.05.0 Draw electrical, plumbing, and HVAC plans
- 26.10.05.01 Draw electrical plan locating receptacle, switch, and lighting outlets
- 26.10.05.02 Draw plumbing plan showing drain vent system
- 26.10.05.03 Draw isometric drawings of building draw/vent system
- 26.10.05.04 Draw HVAC plan locating HVAC diffusers, outlets, equipment

26.10.06.0 Design a residential structure
- 26.10.06.01 Construct floor plan
- 26.10.06.02 Construct a foundation plan
- 26.10.06.03 Construct elevations
- 26.10.06.04 Construct typical wall section and detail
- 26.10.06.05 Construct roof plan

26.10.07.0 Interpret Site Plan
- 26.10.07.01 Identify topographical and existing features of area(s) (i.e., property lines, utilities, streets)
- 26.10.07.02 Identify parcel map
- 26.10.07.03 Identify existing land survey plat

26.11.00.0 Electrical and Electronic Drawings

26.11.01.0 Develop electrical drawings
- 26.11.01.01 Identify components and symbols
- 26.11.01.02 Identify connections
- 26.11.01.03 Draw components according to engineer's sketch
- 26.11.01.04 Draw a wiring schematic

26.11.02.0 Develop electronic drawings
- 26.11.02.01 Identify components and symbols
- 26.11.02.02 Identify connections
- 26.11.02.03 Draw components according to engineer's sketch
- 26.11.02.04 Draw a schematic